

MULTISCREEN DISPLAY SYSTEM

The present invention generally relates to a method and device for utilizing a distributed screen system to facilitate operation of a given device and particularly relates to a method and system for sharing functionality between devices having limited display capabilities.

A conventional system is known that enables a master device to display a given display area across multiple displays. For example, many current video cards for conventional computers allow a display area to be shared by two or more computer monitors. For example, an ATI Radeon 9800 ProTM video card can share a display area across two monitors. The left border of a monitor positioned to the right of a user's view shares a right border of a monitor positioned to the left of a user's view. The two monitors together, display a single display area. In this way, objects that are cut off, for example, by the left border of the monitor positioned to the right continue past the right border of the monitor positioned to the left to give the effect of a single display area shared across the two monitors. This functionality is provided by the video card which splits the display area across the two monitors. The monitors themselves are oblivious to the result in that each merely displays the image data provided to it by the video card.

In U.S. Patent Publication No. US 2002/0197993 and US 2002/0196196, client/server systems are described wherein a centralized server communicates over a network (e.g., wired, wireless) to multiple devices. In operation, the centralized server distributes portions of images across the multiple devices. The devices operate as clients of the centralized server. In these systems, the server acts similar to the ATI Radeon 9800 ProTM video card described above in that the server also decides how the images are distributed across the multiple wireless devices. In this system, it is also shown that multiple wireless devices can also share a single user interface with functions of the user interface distributed across the wireless devices. However, once again, these devices operate in a server/client environment and therefore, the relationship between the devices is determined by the server.

SametimeTM is a product, by IBM Corp. that enables a user to share a display experience across multiple distributed computer systems. In the SametimeTM

environment, the display of actions on one computer system, are mirrored on one or more other computer systems to enable a visual display of the actions across the distributed computer systems. In one portion of the screen of the one or more other computer systems, typing for example of a question, is mirrored back to each computer of the distributed computer systems to enable an ongoing chat environment. Again, in SametimeTM, one computer acts as the master computer display with the other computers acting as slave displays.

In another system, such as shown in United Kingdom Patent Publication No. GB 2,384,064A, a mobile phone is utilized by another device to enable connection of intelligent devices to a network via the mobile phone and mobile phone network. In this system, the phone is the means for the intelligent device to access the wireless network.

A problem exists with this system in that none of these systems enable operation of the devices without having at least a server system to coordinate and manage the distribution of images across the multiple devices. Further, even the distribution of a single user interface across the multiple devices does not add anything to the capabilities of the given devices.

Accordingly, it is an object of the present invention to overcome these disadvantages and/or others of the prior art.

These and other objects of the present invention are achieved by a system including two or more devices that are enabled for screen sharing. In operation, a screen connect function is resident on at least one of the devices. Activation of the screen connect function initiates the screen sharing between the devices. In accordance with the present invention, the screen sharing may include a sharing of a display capability of one device with the other device. Additionally or in place of the sharing of the display capability, other functionality such as processing capabilities, touch screen control, etc. may be shared between devices.

The screen sharing may include a transfer of a user interface or a portion thereof from a first device to a second device. This user interface or portion thereof operated on the second device functions as a user interface or together with the user interface of the first device. The screen sharing may be enabled when the devices are brought into proximity with each other. A screen connect function may initiate the screen sharing.

In either event, by initiating the screen sharing, functionality on one of the devices is utilized to enhance or add functionality for the other device.

These and other features and advantages of the present invention will become more apparent from the accompanying drawings and the following detailed description.

The following are descriptions of illustrative embodiments of the present invention that when taken in conjunction with the following drawings will demonstrate the above noted features and advantages, as well as further ones. It should be expressly understood that the drawings are included for illustrative purposes and do not represent the scope of the present invention. In the figures, like parts of the system are denoted with like numbers.

The invention is best understood in conjunction with the accompanying drawings in which:

FIG. 1 shows an illustrative system in accordance with an embodiment of the present invention; and

FIG. 2 shows a flow diagram illustrating operation of a system in accordance with an embodiment of the present invention.

The present invention will be described below with reference to an illustrative system for the purposes of facilitating a description. It should not be interpreted as limiting the claims appended thereto. The present inventive system is applicable to numerous alternate embodiments that would readily occur to a person of ordinary skill in the art. The alternate systems should be understood to be encompassed by the appended claims.

FIG. 1 shows an illustrative embodiment of a system 100 in accordance with an embodiment of the present invention including a portable wireless device 110 and portable wireless device 150.

The device 110 includes a display portion 120, one or more control buttons 130, and an antenna 140. The device 110 is illustratively shown having the form of a personal digital assistant (PDA). The device 150 includes a display portion 160, one or more control buttons 170, and an antenna 180. The device 150 is illustratively shown having the form of a cellular phone. Clearly, either of the forms of the devices 110, 150 may be substituted for other known devices and still be within the scope of the present invention.

In addition, it is not necessary that the devices 110, 150 be different types of devices. For example, both devices may be cellular telephones. In some embodiments in accordance with the present invention, one of the devices may have better display or other capabilities than the other of the devices. However, it should be expressly understood that even when both devices have equal capabilities, a sharing of capabilities in accordance with the present invention will enhance the capabilities of any one of the individual devices. Clearly other devices may also be operated in accordance with the present invention such as portable multimedia players, portable memory devices, digital still cameras, digital video cameras, wristwatches, other wearable micro displays, such as embedded in glasses, etc. Each of these devices have limitations in abilities including the display of images (e.g., size, functionality, etc.) that would be enhanced by use of the present invention as will be illustratively discussed further below.

It should be understood that in one environment, one of said devices may have capabilities (display, processing, functionality, etc.) superior to those of another of said devices. However, in another environment, the device with inferior capabilities may be superior or equal to another device. For example, with the illustrative devices 110, 150, the device 150 being a telephone device, may have inferior capabilities than the device 110 that is illustratively shown as a PDA. However, if the device 150 is brought into proximity with another device (not shown), which may for example, be a portable multimedia player, then the device 150 may have superior capabilities to the portable multimedia player and therefore operate as the device 110 operates in the included illustrative description. So it should be understood that capabilities may be transferred to or from one device in a given combination of devices, and be transferred from or to that device in another combination of devices.

One aspect of the present invention is that the devices 110, 150 each have the ability to communicate to each other. This may be accomplished via a communication system particularly adapted for operation in accordance with the present invention or it may be accomplished as a by product of a communication system that also has other functionality. Illustratively, this communication may be via a short range communication system, such as Bluetooth communication protocol. The system aspects and protocols for enabling communication between the devices 110, 150 are beyond the scope of the

present invention and should not be understood to limit the present invention unless specific elements are claimed. Clearly, other means for enabling communication between the devices would readily occur to a person of ordinary skill in the art, such as infrared communication (IR), other radio frequency (RF) communication protocols, etc. Illustratively, the devices 110, 150 are shown respectively having antennas 140, 180 that may be enabled for standard operation and/or may be enabled for communication between the devices 110, 150. However, clearly in some embodiments the antennas 110, 150 may be unnecessary or may be concealed.

Further operation of the present invention will be described herein with regard to the illustrative system 100, shown in FIG. 1, and with regard to FIG. 2 that shows a flow diagram 200 in accordance with an embodiment of the present invention.

As illustrated in flow diagram 200, during act 210, two devices, such as mobile devices, are in the vicinity of each other. This proximity condition may have occurred during act 210 or may have been in existence prior to act 210. There is not even really a requirement for any particular proximity between the devices, such as next to each other. In one embodiment of the present invention it may be useful for the devices to be in near proximity to each other. However, all that is really required is that the devices 110, 150 be in sufficient proximity to enable communication between the devices 110, 150.

Thereafter, during act 220 the devices 110, 150 due to proximity, depression of a control button 130, 170 operating as a screen connect button, or other means are enabled for screen sharing that occurs during act 240 in accordance with the present invention. Screen sharing in accordance with the present invention is intended to mean that a display, functionality, user interface or portion thereof etc. of one device, such as device 110, may be utilized to operate functionality, etc. on another device, such as device 150. For example, device 150 is illustratively shown as a cellular telephone. Cellular telephones typically have very limited display capabilities. Device 110 is illustratively shown as a PDA. PDAs typically today have greater capabilities including better processing capabilities and better display capabilities such as larger displays, better visibility, more functionality, such as touch screens, etc. Although, as is clear, the capabilities of the devices may also be equal and yet, by sharing capabilities to perform an operation, the capabilities of any one of the devices would still be enhanced.

In accordance with one embodiment of the present invention, during act 240, at least one of functions, operations, etc. of one device are enabled for manipulation on the other device. For example, during act 240, the phone book and dialing capabilities of the device 150 (shown as a cellular telephone), may now be manipulated on the PDA. It should be understood that this is not intended to show a conventional PDA that is also a cellular phone and thereby the communication in accordance with the present invention does not add functionality. What is intended in accordance with the present invention is that by the direct communication between the devices 110, 150, the heretofore functionality not present on the one device, such as device 110, is enabled or accomplished.

Accordingly, prior to the communication between the devices 110, 150, the ability for instance to manage an address book of the device 150 on the device 110 was not present on the device 110. However, after the communication between the devices 110, 150 in accordance with the present invention, the ability for instance to manage the address book of the device 150 on the device 110 is present on the device 110. This is not the only functionality that may be enhanced however in accordance with the present invention. Other capabilities may also be enabled between the devices 110, 150, such as an ability to view an image on one device, e.g., device 110, which is stored on the device 150.

Further functionality may also be enabled in accordance with the screen sharing of the present invention, for example, perhaps, by a communication in accordance with the present invention between the devices 110, 150, the device 110 may be manipulated to make a telephone call using the display and manipulation capability of the device 110 and the calling capability of the device 150. In this embodiment, by the act 220, the display and functionality of the device 110 may now show display and functionality of the device 150. In other words, the display 120 of the device 110 may now show, for example, a virtual keypad that may be operated for initiating a telephone call. In one embodiment, the display 120 may also be enabled for touch input as is typical for a PDA device. By operation in accordance with the present invention, the touch input capability of the display 120 may be utilized to manipulate the dialing features of the device 150 to initiate a telephone call. Further, perhaps even microphone and speaker capabilities of

the device 110 may operate to further facilitate use of the calling capabilities of the device 150. These abilities may also be a true sharing in that the operation heretofore resident and/or operating on one of the devices, are now operated through use of both devices. For example, it may be useful to edit on the device 110 textual portions of a phone book entry that are resident on the device 150. However, for this same phone book entry, it may be useful to enter a voice identification for this entry directly on the device 150. Accordingly, the term "screen sharing" as utilized herein should be understood to encompass any one or combination of each of these shared capabilities in accordance with the present invention.

In one embodiment, the functionality may be simply facilitating operation of one device, such as device 150, having limited display capabilities, by displaying the same or similar displays on a device, such as device 110, having less limited display capabilities. In this way, the typical displays of the device 150 may merely be shown in a larger format on the device 110. In this operation, the device 150 may transmit complete display information to the device 110. Of course, in other embodiments, simple screen-like descriptions, such as HTML descriptions may be shared by the device 150 with the device 110. Other means of screen sharing may also be utilized such as XML, HAVi-DDI (HAVi Data Driven Input), VNC, etc. There are other known technologies that enable devices to recognize each other, operate together, communicate together, and/or exchange capabilities, etc. that may be adapted for operation in accordance with the present invention including UPnP, XML-RPC, UPnP Remote I/O, etc. These and other means should be understood to be within the scope of the present invention.

In another embodiment, the device 110 may operate to enhance the capability of the device 150 such as through the use of the touch screen described above or through other added functionality borrowed from the displaying device (e.g., device 110). For example, in one embodiment, the processing capabilities of the device 110 may be utilized to further enhance functionality of the device 150 such that more elaborate or configurable display and functionality of the device 150 is enabled by operation through the device 110.

In one embodiment, these features may be brought about by a transfer of the user interface (UI) or portion thereof of the device 150 to the device 110. In this way, the

operation of other portions of the device 110, such as the control buttons 130, may also manipulate features of the device 150 in accordance with an embodiment of the present invention.

These transfers of display capability, UI capability, etc. may optionally occur during act 230 as shown in FIG. 2. In other embodiments, the device 110 may be enabled by having program portions that are resident on the device 110 and that are directed to providing functionality to other devices, such as device 150. In these embodiments, the program portions are resident on the device 110, however are not enabled for operation until the proximity condition between the devices 110, 150 exists or until operation of a screen connect command is initiated on one of the devices 110, 150.

In these or other embodiments, proximity between the devices 110, 150 may initiate an appearance of a screen connect icon 125 on the device 110 or on the device 150 (not shown). The screen connect icon 125 may thereafter be utilized to enable operation in accordance with the present invention as described above, such as previously discussed with regard to the control buttons 130. The proximity condition may actually be a touching of one device to another. This touching or other instantiation (e.g., activation of the screen connect function) may also control what functionality is transferred from a first of these devices to another of these devices. For example, in bringing the device 150 into contact with the device 110, the editing capabilities (larger screen, touch display, etc) of the device 110 may be enabled for editing of the phone book entry resident on the device 150 as described above. However, by bringing the device 110 into contact with the device 150, the voice input capabilities of the device 150 may be enabled for operation of functions resident on the device 110.

In other operations, text entry on one device (e.g., device 110) may support functions on the other device (e.g., device 150). Other functions may enable drag and drop operations between devices and in effect may operate as a drag and drop on a single device. A color display of one device may be useful for applications on the other device. For example, a display on a PDA may only support a grayscale image, whereas a display on a phone may support color images. Accordingly, the color display on the phone in accordance with the present invention may be utilized to view, edit, manipulate, etc. a photo that is resident on the PDA. A scroll wheel resident on a phone may be very useful

in going through lists that are stored on a PDA. As discussed above and as should be clear from these examples, the screen sharing abilities may migrate from either device to another device. This may be selectable by the user or may be a function of what screen sharing capability is being shared between the devices.

Another example of screen sharing capabilities may be utilizing processing capabilities of the device 110 to edit an image that is resident on the device 150. This may be useful since many phone devices today have an ability to take photos using a camera resident on the phone. However, due to limitations of the camera, these photos often have inferior display qualities. However, in accordance with the present invention, the screen sharing may be utilized to enable the device 110 to edit and enhance the photo and thereby, make a better quality photo available for use on the device 150 than otherwise may be available.

A person of ordinary skill in the art would readily appreciate that there are numerous ways of achieving the above described functionality. Accordingly, the described embodiments should be understood to not be limited to any one particular alternative.

The embodiments of the invention described above are intended for purposes of illustration only, and should not be construed as limiting the appended claims to any particular embodiment or group of embodiments. Numerous alternative embodiments may be devised by those having ordinary skill in the art without departing from the spirit and scope of the following claims.

In interpreting the appended claims, it should be understood that:

- a) the word "comprising" does not exclude the presence of other elements or acts than those listed in a given claim;
- b) the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements;
- c) any reference signs in the claims do not limit their scope;
- d) several "means" may be represented by the same item or hardware or software implemented structure or function;

e) each of the disclosed elements may be comprised of hardware portions (e.g., including discrete and integrated electronic circuitry), software portions (e.g., computer programming), and any combination thereof;

f) hardware portions may be comprised of one or both of analog and digital portions;

g) any of the disclosed devices or portions thereof may be combined together or separated into further portions unless specifically stated otherwise; and

h) no specific sequence of acts is intended to be required unless specifically indicated.